1. SUBMIT TO: **AS04**

2. Conference Title: **Interferometry in Optical Astronomy**
   Conference Chair: **Francesco Paresce**

3. ABSTRACT TITLE: **50 picometer Fiber Length Measurement for Fiber Based Full Aperture Metrology ~~for Space Interferometry Mission~~**

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5. PRESENTATION: **Oral Presentation**

6. ABSTRACT TEXT

We describe our fiber length measurement effort where we are attempting to measure two fibers relative to one anther to 50 picometer accuracy. In a fiber based full aperture metrology (FAM) - presented elsewhere in this conference - one of the most critical measurement is the relative phase of the fiber output beams. This phase knowledge translates to fiber length measurement in our system.

In our fiber length measurement testbed, a single fiber laser source is split into two paths by a 2x2 polarization maintaining coupler. Each of the fiber arm passes through an acousto-optic frequency shifter for heterodyne detection and a fiber squeezer. The reflected beams from the fiber tips are combined at the 2x2 coupler and its phase is measured. The reflected signal phase should have twice the single pass phase (or pathlength) difference in the absence of non-reciprocity. The transmitted signal from the two fiber tips are combined interferometrically and its phase is compared to that of the reflected signal. If the difference in the signals is less than 50 pm in the presence of fiber perturbation, we can confidently declare that the output phases of the two fiber sources in FAM can be measured to the required accuracy of SIM.

One key technique that we have developed for the fiber length measurement is the use of fiber squeezers. We will show that the noise that arises from backreflections and polarization coupling in the fiber must be suppressed and that the cyclic averaging by modulating fiber length in a proper manner can achieve this goal.

7. KEY WORDS

Fiber, metrology, picometer

8. BRIEF BIOGRAPHY (of principal author) ~ 50 words

Received B.S. in EECS at U.C. Berkely, in 1979; Ph.D. in Electrical Engineering at Univ. of Southern California in 1986. From 1986 to 1998, worked at Rockwell Science Center doing basic and applied research on many different types of nonlinear optical phenomena and devices, including four-wave mixing, phase conjugation, image processing, RF photonics, and holographic memory, using cw to femtosecond lasers. Since 1998, have been working on picometer metrology for Space Interferometry Mission at Jet Propulsion Lab.